

REMARKS

Applicants respectfully request reconsideration of the present application in view of the reasons that follow. Claims 41, 42, 45, 47-50, 53-58, 61-81 are currently pending in the present application.

I. Interview Summary

Applicants thank the Examiner for the interview of July 19, 2010. During the interview, Applicants' representatives and the Examiner discussed where in the references certain claim elements were allegedly found. No agreement was reached. The Examiner requested that the issues be raised in the present response.

II. Claim Rejections Under 35 U.S.C. § 103

On page 3 of the Office Action, Claims 41, 42, 45, 47-50, 53-58, and 76-81 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 7,505,788 to Narasimhan (hereinafter "*Narasimhan*") in view of Dabak et al., "Signal Constellations for Non-Gaussian Communication Problems," Statistical Signal and Array Processing, Minneapolis, April 27-30, 1993, Proceedings of the International Conference on Acoustics, Speech and Signal Processing (ICASSP), New York, IEEE, US, 4:33-36 (hereinafter "*Dabak*"), further in view of U.S. Patent No. 6,023,493 to Olafsson (hereinafter "*Olafsson*").

A. Claims 41, 49, and 54-57 and 76-78

The combination of references fails to disclose "selecting a signal constellation ... based on an indication of a number of transmit antennas used in transmitting the modulated carrier wave."

Claim 41 recites in part:

wherein said **selecting a signal constellation** from a plurality of stored signal constellations is **based on an indication of a number of transmit antennas** used in transmitting the modulated carrier wave.

(Emphasis added.) The Examiner states:

Regarding claims 41, 49, 54-57 and 76-78, Narasimhan discloses a method of transmitting a signal utilizing the

communication system shown in figure 1. The transmitter 150 or receiver 115 includes an antenna selection module 150. The antenna selection module selects a subset of antennas at the transmitter and receiver as shown in figure 2 (column 3, lines 6-10). **The antenna selection operation may select an optimum number of transmit antennas and corresponding symbol constellations using channel correlation matrices (column 3, lines 14-16). Once the optimum number of antennas is selected (column 4, lines 34-35), the constellation for transmission is then selected (column 4, lines 40-41). Some types of constellations are disclosed in column 4, lines 40-49.** Data will be input to the communication system, converted to symbols to be transmitted according to the selected transmit constellation, modulated on a carrier wave and transmitted to the receiver (figure 1). The antenna selection module 150 at the receiver may determine the number of transmit antennas and transmit the results to the transmitter (column 4, lines 50-56).

(Emphasis added.) *Narasimhan* states:

The antenna selection operation may select an optimum number of transmit antennas and corresponding symbol constellations using channel correlation matrices. The channel correlation matrices are second-order statistics of the propagation medium 140, which change much more slowly than the actual fading of the channel themselves. Since the second-order statistics are relatively stable, **the correlation matrixes may be determined using long term averaging.** This may alleviate the need to frequently update the configuration of active antennas in the system.

(Col. 3, lines 14-23. Emphasis added.) Thus, *Narasimhan* describes a system where constellations are being selected from correlation matrixes that are based on the propagation medium. Further, *Narasimhan* states:

Once the optimum number of antennas is determined, the actual antennas in the subset may be selected (block 210). The active antennas at the transmitter 105 and the receiver 115 may be selected to provide the largest spacing between adjacent antennas in the antenna array to further minimize correlation.

The constellation for transmission is then selected (block 215). The constellations may be selected from, e.g., binary phase shift keying (BPSK), quadrature phase shift keying (QPSK), 8-point phase shift keying (8-PSK), 16-point

quadrature amplitude modulation (16-QAM) and 64-QAM.

The number of points transmitted, and hence, the constellation for the antennas, may be determined from $(2^{b_T/M_T})$. Once the antennas are selected, the transmitter 105 may transmit b_T/M_T bps/Hz from each transmit antenna (block 220).

(Col. 4, lines 34-49. Emphasis added.) This section suggests the possible types of modulation constellations that may be selected. Thus, nothing in *Narasimhan* describes “wherein said selecting a signal from a plurality of stored signal constellations is based on an indication of a number of transmit antennas used in transmitting the modulated carrier wave” as in Claim 41 and similarly claimed in Claims 49 and 57.

Inspection of *Dabak* and *Olafsson* fails to show at least this missing element.

The combination of references fails to disclose “the selected signal constellation including a plurality of constellation points selected by maximizing a minimum Kullback-Leibler distance between the plurality of constellation points.”

The Examiner acknowledges:

Narasimhan does not disclose the method selected signal constellation includes a plurality of constellation points selected by maximizing a minimum Kullback-Leiber distance.

The Examiner cites *Dabak* as allegedly supplying this missing element:

However, *Dabak* discloses a method of computing optimum signal sets (abstract). By optimizing the constellation points for non-Gaussian communication problems, the problems can be overcome and proper communication between users can be achieved. This optimization is achieved since the Kullback information can be used to express how performance varies with noise amplitude distribution and with signal set choice (III). Additional information regarding the Kullback information is provided in heading II. It would have been obvious for one of ordinary skill in the art at the time of the invention to provide this simple substitution of the constellations of *Dabak* for the constellations of *Narasimhan* since the constellations will operate in substantially the same manner and will yield predictable results. In addition, the combination will achieve the results stated above in *Dabak*.

However, Dabak does not describe “the selected signal constellation including a plurality of constellation points selected by maximizing a minimum Kullback-Leibler distance between the plurality of constellation points” as claimed. In Section 3, *Dabak* states:

The asymptotic relation of Kullback information to performance probabilities and its indirect relation to squared distance between measures allows us to construct an analog to signal space for detection problems. We can visualize the M hypotheses as constituting a "constellation" of probability measures P_i in P . The Kullback information plays the role of squared distance in this space and the exponential mixture curves (equation 2) the role of straight lines. As a consequence of the Kullback's theorem we can use $I(P_i|P_j)$ as a measure of the normalized intersignal distance between the hypotheses H_i and H_j , a measure that can be related to performance and to a signal constellation. In the Gaussian case, $I(P_i|P_j) = d_{ij}$, which leads to the Euclidean geometry on R and signal constellations which are rotation invariant: the choice of basis for signal space is arbitrary and waveform has a secondary effect on performance. For small M , **we can calculate optimal signal sets by maximizing the sum of all intersignal distance measures under a signal-related constraint.** In this paper the formal optimization problem for designing optimal signal sets **is to maximize the total distance measures subject to an equal energy constraint.**

(Section 3, lines 9-30. Emphasis added.)

Thus, *Dabak* can be seen to be maximizing the sum of all intersignal distance measures under a signal-related constraint. There is no suggestion within *Dabak* that this is similar to a “maximizing a minimum Kullback-Leibler distance between the plurality of constellation points” as claimed. In section 2 of *Dabak*, Kullback information is stated to always define a squared-distance-like quantity on the detection theoretic manifold of probability measures. However, nowhere within *Dabak* is discussed a minimum Kullback-Leibler distance, much less selecting constellation points “by maximizing a minimum Kullback-Leibler distance between the plurality of constellation points” as in Claim 41 and similarly claimed in Claims 49 and 57. Further inspection of *Olafsson* fails to find this element acknowledged missing from *Narasimhan*.

Thus, *Narasimhan*, *Dabak*, and *Olafsson*, alone or in combination, fail to show at least “selecting a signal constellation from a plurality of stored signal constellations, the selected signal constellation including a plurality of constellation points selected by maximizing a minimum Kullback-Leibler distance between the plurality of constellation points” and “wherein said selecting a signal constellation from a plurality of stored signal constellations is based on an indication of a number of transmit antennas used in transmitting the modulated carrier wave” as in Claim 41 and similarly claimed in Claims 49 and 57. Claims 42, 45, 47, 48, 50, 53-56, 58 and 76-78 depend from the independent claims. For at least these reasons, Applicants respectfully request that the Examiner withdraw the rejection of Claims 41, 42, 45, 47-50, 53-58, and 76-81.

B. Claims 61-75

On page 6 of the Office Action, Claims 61-75 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Narasimhan*, in view of *Dabak*, in further view of U.S. Patent No. 7,269,436 to Won (hereinafter “*Won*”), in further view of *Olafsson*, in further view of U.S. Patent Publication No. 2006/0209982 to De Gaudenzi et al. (hereinafter “*De Gaudenzi*”). Further inspection of *Won* and *De Gaudenzi* does not, alone or in combination, disclose the elements found to be missing in the argument of section A. Claims 61-75 depend from the independent claims. For at least these reasons, Applicants respectfully request that the Examiner withdraw the rejection of Claims 61-75.

Applicants believe that the present application is in condition for allowance. Favorable reconsideration of the application is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

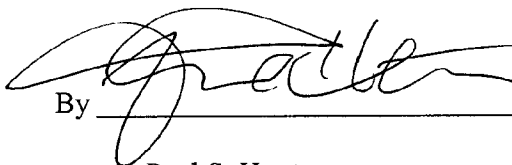
The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by the credit card payment instructions in EFS-Web being incorrect or absent, resulting in a rejected

or incorrect credit card transaction, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extension of time is needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extension fees to Deposit Account No. 19-0741.

Respectfully submitted,

Date July 27, 2010

By



FOLEY & LARDNER LLP

Customer Number: **23524**

Telephone: (608) 258-4292

Facsimile: (608) 258-4258

Paul S. Hunter

Attorney for Applicants

Registration No. 44,787